

Implementation of Food Safety Management Systems in small food businesses in Cyprus

Charalambous, Marianna; Fryer, Peter J.; Panayides, Stephanos; Smith, Madeleine

DOI:

[10.1016/j.foodcont.2015.04.004](https://doi.org/10.1016/j.foodcont.2015.04.004)

License:

Other (please specify with Rights Statement)

Document Version

Peer reviewed version

Citation for published version (Harvard):

Charalambous, M, Fryer, PJ, Panayides, S & Smith, M 2015, 'Implementation of Food Safety Management Systems in small food businesses in Cyprus', *Food Control*, vol. 57, pp. 70-75.
<https://doi.org/10.1016/j.foodcont.2015.04.004>

[Link to publication on Research at Birmingham portal](#)

Publisher Rights Statement:

NOTICE: this is the author's version of a work that was accepted for publication in Food Control. Changes resulting from the publishing process, such as peer review, editing, corrections, structural formatting, and other quality control mechanisms may not be reflected in this document. Changes may have been made to this work since it was submitted for publication. A definitive version was subsequently published in Food Control, Vol 57, November 2015, DOI: 10.1016/j.foodcont.2015.04.004.

Eligibility for repository checked

General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

Take down policy

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact UBIRA@lists.bham.ac.uk providing details and we will remove access to the work immediately and investigate.

Accepted Manuscript

Implementation of Food Safety Management Systems in Small Food Businesses in Cyprus

Marianna Charalambous, Peter J. Fryer, Stephanos Panayides, Madeleine Smith



PII: S0956-7135(15)00201-7

DOI: [10.1016/j.foodcont.2015.04.004](https://doi.org/10.1016/j.foodcont.2015.04.004)

Reference: JFCO 4381

To appear in: *Food Control*

Received Date: 3 November 2014

Revised Date: 1 April 2015

Accepted Date: 7 April 2015

Please cite this article as: Charalambous M., Fryer P.J, Panayides S. & Smith M., Implementation of Food Safety Management Systems in Small Food Businesses in Cyprus, *Food Control* (2015), doi: 10.1016/j.foodcont.2015.04.004.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

**Implementation of Food Safety Management Systems
in Small Food Businesses in Cyprus**

**Marianna Charalambous^a Peter J Fryer^a,
Stephanos Panayides^b and Madeleine Smith^{a*}**

^aSchool of Chemical Engineering, University of Birmingham, Edgbaston
Birmingham B15 2TT, UK

^bTechnical and Agricultural School, Avgorou, 5515, Cyprus

Corresponding Author Madeleine Smith Tel: (+44) (0) 121 414 5291; Fax:

E-mail: M.P.Smith.20@bham.ac.uk

Key words: HACCP ; Small medium enterprises ; SME, Cyprus, food safety management
systems,

Abstract

EU legislation requires that food businesses in all member states must implement a food safety management system based on HACCP principles. Although manufacturers have used this system successfully for many years it has been less common in small and medium sized enterprises (SMEs), especially those in the food service sector. There are considered to be a number of barriers which small businesses find particularly difficult to overcome. This study assesses the impact of various food safety management systems in 50 small businesses in Cyprus. It compares food hygiene before, during, and after implementation of the food management systems, assesses the attitude of the Food Business Operators and the hygiene knowledge of the staff. Results show that the maximum improvement came when implementing the pre – requisite programmes and a bespoke HACCP plan but that a deterioration in standards could be identified when using more complex systems such as the CYS 244 standard or ISO 22000. Food Business Operator attitude started positively but became more negative as the complexity of the Food Safety Management System increased.

1.Introduction

1.1 Background

The implementation of Food Safety Management Systems (FSMS) in small and medium food businesses can be problematic owing to barriers and limitations which, although common to all food businesses, appear to be particularly challenging for this category (Mensah & Julien, 2011; Yapp & Fairman, 2006). EU legislation requires that all Food Business Operators implement a system based on HACCP principles (Article 5, Regulation (EC)852/2004). All member states must comply with this requirement. For accession countries joining the EU, this requirement can represent a challenge to the existing food industry and control authority alike. Cyprus joined the EU in 2004 and according to the Statistical Service of Cyprus (Anonymous, 2005) 95% of businesses in Cyprus have 0-9 employees. Food businesses in Cyprus tend to be independent and owned by one person or a family, with 97.3% classed as small- medium sized i.e. employing less than 50 people (Violaris, *et al.*, 2008). This business profile suggests that the Cypriot Food Industry might face some difficulties in complying with the EU legislation. Violaris *et al* (2008) estimated that only 17% of food businesses in Cyprus had implemented HACCP and that more than half (55%) of the small businesses did not know what HACCP was. To assist the food businesses comply with the EU regulations, the Cyprus Government organized a system of external consultancy companies. These companies offered mandatory assistance to the food industry to enable compliance. Fees were charged to the business for the consultancy service which included basic food hygiene and HACCP training, an initial diagnostic visit to identify areas for attention, subsequent visits to provide advice on structural and procedural matters and assistance in developing and implementing a bespoke HACCP plan.

1.2 Food Safety Management in Cyprus

On becoming a member of the European Union in 2004, food businesses in Cyprus were required to comply with the Council Directive 93/43/EEC on the Hygiene of Food stuffs. This contained a requirement for food safety management based on HACCP but allowed some flexibility in the interpretation, reflecting the nature and size of the food business. At this time there also existed in Cyprus a national HACCP standard, the CYS 244 standard, (Anonymous, 2001a) based on the Greek national standard EAOT 1416 (Anonymous, 2000). The CYS 244 standard required implementation of pre-requisite programmes and the seven principles of HACCP in full, including documentation. It represented a more prescriptive standard than that

detailed in the Council Directive 93/43/EEC on the Hygiene of Food stuffs, and was, at the time of accession, optional for the restaurants in Cyprus. HACCP certification was available to any food business that could demonstrate compliance with both the EU legislation and the CYS 244 standard through third party audit. Such certification was not required by EU legislation but, after accession, was demanded by the Cypriot Government for all food businesses, including food service, thereby creating an enhanced standard for the Cypriot Food Service sector. In 2006 the CYS 244 standard was withdrawn and food enterprises were expected to comply with the new international standard, ISO 22000. This standard requires implementation of the pre-requisite programmes and the seven principles of HACCP plus interactive communication and structured management standards. ISO 22000 is supported by technical standards and requires third party audit to retain accreditation. These policy changes and the continual enhancement of standards provided an additional challenge for the Cypriot food industry and the private consultants also provided training and advice on how these could be implemented.

As the implementation of food safety management systems in parts of the food industry had been optional in Cyprus prior to accession, but obligatory afterwards, there existed a unique opportunity to follow a sample of food businesses through the process of implementation and assess the impact on them.

The aim of the research was to test whether hygiene in the study group premises was improved during the implementation of Food Safety Management Systems . Data was also collected on a number of other parameters, including the hygiene knowledge of staff, the attitude to FSMS, the compliance of food, environmental and water samples from the premises and the cost of FSMS implementation. This information was used to assess the attitude and opinions of the Food Business Operators and staff about Food Safety Management Systems.

2. Materials and Methods

2.1 Study group

The project was a longitudinal study which took place between October 2005 and April 2008. One member of the research team was at that time employed in the consultancy scheme described above and was responsible for providing comprehensive support and training to food businesses in the process of implementing HACCP. The study recruited an opportunistic sample that comprised all those premises allocated to the researcher in 2005. The food businesses had all formally applied for the consultancy support. Implementation of a Food Safety Management System was a legal requirement and Food Business Operators in Cyprus were required to comply or face possible closure of the business. The consultancy scheme was a government

supported with universal uptake by the businesses. This made the inclusion of a matched control group in the study impossible. The sample group included restaurants, fast food enterprises, catering premises, traditional tavernas, confectionaries, meat products premises and bakeries, reflecting the range of businesses trading on the Island of Cyprus.. The participants were located in all areas of the Island and none had more than 21 employees. These characteristics indicate that the composition of the sample group was representative of the food businesses in Cyprus. In total fifty volunteer SME's were recruited to participate in the study. Cochran's equation (confidence level 95% and precision 10%) identified a minimum sample size of 45 premises (Cochran, 1977). During the study each business was provided with support from the consultancy scheme. This support covered training and implementation. Between stage 1 and 2, participants received introductory training in food hygiene and HACCP and assistance to implement the pre-requisite programmes, including the development of a sampling plan. After stage 2, they were given training in the principles of HACCP, assistance in developing a HACCP plan and the use of food hygiene guides to assist compliance. After stage 3 the CYS standard was introduced and after stage 4 participants were trained in the details of ISO 22000.

2.2 Ethical consideration

All Food Business Operators were fully informed of the purpose of the study which was designed to run alongside the implementation of their system. The voluntary nature of their participation and how the data would be anonymised and used was explained. After discussing the matter they were given the option to participate or not. All 50 allocated in 2005 agreed to participate.

2.3 Audit

Premises hygiene was assessed using an audit tool developed for the purpose. The audit was developed after consideration of standard hygiene criteria such as those listed in official control audits (EFET, 2004) published audit sheets (Smith, *et al.*, 2004). The criteria were assessed by visual inspection or through consideration of documentation, for example temperature monitoring records. The contents of the audit sheet were evaluated by experts from Academia and from the Control Authorities. The final audit consisted of 175 observations, each of which could be answered as 'yes' or 'no'. The questions were worded in such a way that a 'yes' answer indicated a good hygiene practice while a 'no' answer indicated poor hygiene practice, for example 'are hand washing facilities supplied with paper towels or other hygienic means of drying hands?' 'Yes' indicates the premise is hygienic in this matter while 'no' indicates it is not.

Every 'yes' answer was allocated one point; every 'no' was allocated 0. The final score for each premises was calculated by summing the points. The maximum score a premises could achieve was 175, the minimum was 0. The audit required approximately 1.5 hours to complete, depending on the size of the premises. The outcome of the audit was a numerical score. The higher the score, the better a premises complied with the requirements of the audit. The audit was divided into five parts: Part A: Structure and Facilities, Part B: Cleaning and Disinfection, Part C: Production and Process Control, Part D Sampling and Part E: HACCP implementation. The audit tool was validated by the test- retest method in 19 premises and scores were analyzed using the Mann Whitney U test. There was no significant difference in the scores between validation visits to the same premises ($p>0.05$) or between different researchers.

2.4 Food Hygiene Knowledge

Staff working in the study premises were assessed on the level of their knowledge of food hygiene at each of the five visits noted in section 2.7. This was achieved by designing a test which covered basic food safety and hygiene knowledge. The test comprised multiple choice questions and other assessments based on selecting pictures, completing sentences and providing definitions. The questions asked about personal hygiene, cleaning and sanitation, pest control, temperature control and cross contamination. Some questions related to HACCP principles and terminology and hazard identification. All staff working in the participating premises completed the test and this participation provided a sample of 438 food handlers. The test was validated by experts from Academia and from the Control Authorities with expertise in delivering and assessing training of this type (Charalambous, 2011))

2.5 Attitude

A self administered assessment tool was developed to assess the attitudes of the Food Business Operators to Food Safety Management Systems. In consultation with two food safety specialists and three statisticians, a number of questions were developed to assess the Food Business Operator's attitude to Food Safety Management Systems using a 6 point Likert scale. Cronbach's alpha coefficient was used to test reliability and internal consistency. Some questions were eliminated and the final questionnaire comprised 14 questions, some of which were reverse phrased, with a Cronbach's alpha coefficient of 0.5. The value is quite low but is affected in this case by the heterogeneity of the items included.

2.6 Environmental, Food and Water samples

Four accredited Laboratories participated in the study by visiting the 50 food premises to collect and analyze environmental, food and water samples. In each premises a stainless steel surface was swabbed and the total viable count measured. The same type of surface was swabbed for consistency, and stainless steel surface was selected as this could be found in all premises in the study group. Surfaces were swabbed using a sterile poly-cotton headed swab (Biomérieux Hellas). which had been hydrated in letheen broth, in a sealed sterile container. A sample area of 64 cm² was swabbed, using a template and a width-wise back and forth motion across the surface. The swab was replaced in the container and taken to the relevant accredited laboratory for analysis.

Water samples were taken from all participating premises and tested for standard parameters and the results were reported as being compliant or not with the national standards. Table 1 indicates the parameters assessed and the relevant quality standard which sets the accepted level for each parameter.

Food samples were also taken for every food premises. The sample group included a wide range of business types and food stuffs. Each business was assessed individually and five high risk foods identified in each of them. These selected foods were then tested for compliance based on either Commission Regulation (EC) NO 1441/2007 on microbiological criteria for foodstuffs (in force at the time of the study) or the Cypriot standard for microbiological criteria for food (General Chemical State Laboratory, 2001). For foods or parameters not covered in either of the above, other relevant international standards were consulted, for example ISO 4833:1991 for aflatoxins.

2.7 Data collection

Data was collected five times from every participating premises. These collection points corresponded to

1. Before any implementation
2. After the implementation of the Pre-Requisite Programmes
3. After the implementation of the 7 principles of HACCP
4. After implementation of the CYS 244 national standard
5. After implementation of the international standard ISO 22000

At each data collection point, an audit was completed. The same audit sheet was used throughout the study for each premises and at every level. The food premises staff completed the food hygiene test of section 2.4 at three points (1,2 and 4). The environmental, food and

water samples were gathered at all data collection points. The Food Business Operators completed the attitude survey at points 2-5.

2.8 Cost

Data was collected on the cost of the process to the businesses. This was divided into infrastructure costs (building and equipment changes), provided by the businesses accountants, and implementation costs. Implementation costs were calculated using the time sheets associated with the consultancy work carried out in each premises. The cost for the consultancy was €65 per hour.

2.9 Analysis

Statistical analysis was carried out using SPSS 16 for Windows.

The purpose of the audit was to track any changes in score that occurred in the sample group over the period of the study. The audit results represent matched pairs so The Wilcoxon Signed Rank test was chosen to test for significance between the scores at each collection point (points 1-5 explained above). As four comparisons were being made, the Bonferroni correction was applied ($0.05/4$) to give a critical level of 0.0125. The attitude questionnaire given to the manager/owner was analysed in the same manner, using Wilcoxon Signed Rank test to test for significance between the four evaluations and a critical level of 0.0125.

The scores from the hygiene test taken by the staff in participating premises were tested using the Wilcoxon Signed Rank test to determine if there was any significant difference in the scores at level 1, 2 and 4.

The Environmental Samples were swabs taken from designated surfaces in each food premises. Total viable counts were reported for each sample and log transformed. The resultant data was tested for normality using Kolmogorov-Smirnov test and, when found not to be normally distributed, analysed using the Mann -Whitney test for independent samples. The Bonferroni correction was calculated and a critical value of 0.0125 applied.

Five food samples were taken in each premises at every collection point. The foods were analysed according to the relevant standard and reported as being compliant or non-compliant for the relevant parameters. The proportion of compliant and non compliant samples at each stage was compared to determine if compliance was improving as the study progressed. Chi Square was used to determine if the differences were significant using a critical level of 0.05.

3. Results

3.1 Audit

Table 2 presents the median scores for the sample group at each audit. Part A of the audit related to the premises structure. The scores for the sample group increased through audit 1-3 as the Food Business Operator improved the building, equipment, surfaces and other such facilities. The audit score differences between audit 1 and 2 and between audit 2 and 3 were significant ($p < 0.01$, Wilcoxon Signed Rank test). Although there was also an improvement in audit score between audit 3 & 4, it was not significant ($p = 0.039$) and no further increase occurred between audit 4 and 5. The maximum possible score in this section was 33 and the median score for the group in both audit 4 and 5 was 27.73. This suggests the majority of structural improvements were carried out during the early stages of the study and once the group achieved a high level of compliance, no further changes were made in structure.

Part B of the audit represents the levels of cleaning and disinfection carried out by the sample group. The score for this section improves to a maximum in audit 3 and then decreases by audit 4 and again in audit 5. All differences were significant ($p < 0.01$, Wilcoxon Signed Rank test). However the median score in audit 5 is still higher than in audit 1, indicating a sustained improvement.

Section C (process controls) also shows an improvement in score followed by a decrease. In Section C the maximum median score is found in audit 4. The difference in audit score is significant between all audits ($p < 0.01$, Wilcoxon Signed Rank test). However the difference between the audit score for Section C at audit 1 is not significantly different from the score at audit 5 ($p = 0.04$), indicating no sustainable improvement occurred over the period of the study.

Section D of the audit assessed whether food water and environmental samples were being taken in the study group. The scores improve to audit 4 and then remain the same in audit 5. The difference in the scores over the first 4 audits are significant ($P < 0.01$, Wilcoxon Signed Rank test). This section assesses whether the samples were being taken, not whether they complied with the required standards. As the samples were collected by independent laboratory staff who were being paid for the process, this section of the audit really represents the point at which the Food Business Operator organised the sampling and doesn't reflect further action or compliance on the part of the business.

The final part of the audit, Part E, measured the Food Business Operator's success in implementing HACCP. This part was used for audits 3, 4 and 5 since at audit 1 and 2 there was no HACCP in the premises, so the score was 0. The scores improve between audit 3 and 4 and then deteriorate in audit 5. The differences were highly significant with $p < 0.01$ (Wilcoxon Signed Rank test).

3.2 Food Hygiene Knowledge

The test scores of the 438 staff working in the participating food premises were compared after each level. The scores improved from a mean score of 39.7% on the first assessment to 85.9% on the second and 94.1% on the third (level 4 after implementation of the CYS 244 standard). The difference between the scores was significant, $p < 0.01$ (Wilcoxon Signed Rank test).

3.3 Attitude

The attitude questionnaire was designed to give an indication of how positively the Food Business Operator felt towards the Food Safety Management System that had been implemented. This attitude questionnaire was completed by the manager of the business at four points, after the implementation of the PRP'S, after implementation of HACCP, after implementation of the CYS 244 standard and after implementation of ISO 2200. A higher score indicated a positive attitude while a lower score indicated a poorer attitude. The mean scores for the study group change significantly at each evaluation. The mean score at the first assessment was 43.56. This had increased to 47.32 after the implementation of HACCP but had reduced to 43.12 after implementation of CYS 244 and dropped further to 39.82 after implementation of ISO 22000. Not only are all the differences significant ($p < 0.01$, Wilcoxon Signed Rank test) but the final score is lower than the first, indicating that the Food Business Operators had become disenchanted with the systems and had become more negative towards Food Safety Management Systems by the end of the study. The attitude questionnaire also contained a single yes/no question which was not included in the attitude analysis. This question simply asked the Food Business Operator if they were considering cessation of the system. At the first evaluation 90% of the respondents answered 'NO' to this question. At the final evaluation 90% answered 'YES'.

3.4 Environmental, Food and Water Samples

The mean and standard deviation for the results from Environmental swabbing are shown in table 3. The mean value decreases from sample point 1 to sample point 4 after which it rises again. The differences are not consistently significant, but the final result is lower than the initial reading indicating overall improvement, in spite of deterioration between points 4 and 5. These measurements reflect the cleaning carried out in the premises and the audit results for part B (cleaning) show the same pattern.

3.5 Food Samples

There were five sampling points with 250 samples being taken each time ($n=250$). At the first sampling point, prior to the implementation of any systems, 21 (8.4%) of the food samples were reported to be non compliant. After implementation of the PRP's (stage 2) this dropped to 15 non-compliant samples (6%). At sampling point 3 (after implementation of HACCP) the non compliant samples were also 15 (6%) but at stage 4 and 5 (after implementation of CYS and ISO 2200) the number of violations increased to 22 (8.8%) and 27 (10.8%) respectively. Although there were more non compliances at the end of the process than there had been in the beginning, these differences were not found to be statistically significant.

3.6 Water Samples

One water sample was taken from every premises at each sampling point. These were reported as being compliant or non compliant with the CYS, APHA or EAOT standard according to the parameter tested. Results for chemical standards were consistent through out the study with 2% of the samples reported as noncompliant. Results for microbiological standards showed a reduction in non-compliant samples from 34% at stage one to 20% at sampling points 4 and 5.

3.7 Cost

The cost to the business of implementing the food safety management systems described in this study varied within the sample group. Structural costs ranged from a minimum of €1200 to a maximum of €30,000. The average cost for structural change within the sample group was €10,896. Implementation costs also varied widely from a minimum of €3000 to a maximum of €25,000 and an average of €10,750. The minimum spent by any single business over all was €4,200 and the maximum was €48,400.

4. Discussion

All sections of the audit score show the sample group made improvements in hygiene during the study by comparison with their score at the beginning. However, Sections B (cleaning and Disinfection), C (process controls) and E (Food Safety Management System implementation) all show an improvement to a maximum (either level 3 or 4), after which they deteriorate. Level four represents the stage at which the businesses were supposed to implement the CYS 244 standard and level 5 ISO 22000. The implication from these sections of the audit is that the businesses were able to demonstrate an improvement in hygiene using the PRP's and HACCP, but once they attempted the more onerous and complex CYS 244 and ISO 22000, they were less successful and the standards dropped.

The same pattern can be seen in the attitude scores from the Food Business Operators. At the first assessment the mean score was 43.56 which rose after implementation of HACCP to 47.32. However once the CYS 244 standard was attempted, the Food Business Operator attitude became more negative and finally after attempting the ISO 22000, it was more negative than at the start of the process, mean score of 39.54 compared to 43.56 at the start. This suggests that the deterioration in audit score may be a reflection of the increasingly negative attitude of the Food Business Operator. When asked if they wished to stop implementing the Food Safety Management System, 90% of the participants said yes after trying to implement ISO 22000, while only 10% answered 'yes' after trying to implement HACCP. ISO 22000 is not an appropriate system for small food businesses because of its management, communication and audit requirements and the results from this study suggest that forcing a food business to implement a system which is too complex can result in a deterioration of standards instead of an improvement. This study finished in 2008. In 2014 the sample group was revisited and it was discovered that five of the 50 businesses had closed. Of the remaining 45, only seven were still using the HACCP system and none were using CYS 244 or ISO 22000. The remaining 38 premises were using only pre-requisite programmes with limited record keeping. None of the premises were formally audited on the re-visit, so hygiene scores cannot be compared.

Two sections of the audit did not show the pattern described above. Section A measured the changes in structure and equipment in the sample group. The scores in part A increased to a maximum at stage 4 and remained at that level. The likely explanation is that once a Food Business Operator had paid to improve the structure of the premises, he was unlikely to rip that alteration out however disenchanted he became with the Food Safety Management System being implemented. Part D (sampling) also plateaued at stage 4. This score did not represent the compliance of the samples, only if they were taken or not. As a consequence the score

reflects the diligence of the laboratory technicians in collecting the samples rather than hygiene standard in the premises. The Environmental swabs indicate the efficacy of cleaning and disinfection in the premises and reflect the pattern of improvement to a maximum, then deterioration demonstrated by section B of the audit sheet. In both sets of data the final measurements are higher than the originals, indicating that over the study period sustained improvement did occur, although the final results are not the maximum that could be achieved. Staff were given regular formal training and support during the implementation period. From the test scores (sample group mean of 39.7% on the first assessment and 94.1% on the third and final) it can be seen that there was a significant improvement in their hygiene knowledge. An improved knowledge of hygiene could contribute to any improvement in practices such as cleaning and process controls. The final score for both these sections of the audit is higher than the original, suggesting that sustained improvement has occurred and that the increased hygiene knowledge of the staff may have contributed to that change.

The water used in all the premises in this study was sourced from the main water supply in Cyprus. Water supplied in this way is treated at authorised treatment plants. The high level of chemical compliance of the water sample results reflect the efficacy of the Cypriot treatment and a lack of post treatment contamination in the food premises. The level of microbiological non-compliance suggest that while the majority of samples are compliant there may be potential for improved cleaning in a minority of the premises, a view supported by the environmental samples and part B of the audit sheet.

As explained in the methodology, due to the legal requirement and government support for food businesses in Cyprus during the study period, it was not possible to identify a control group. Audits scores and attitude measurements from a sample of premises who were not participating in the consultancy scheme and who did not implement any Food Safety Management Systems over the same period would have been a valuable comparison. However, the method has been used in previous studies where a control group was possible (Kirby, 1997). In this case the changes in premises hygiene as a result of the intervention were confirmed by comparison with the control group, suggesting that the methodology used here is valid.

All the participants in this study were obliged to spend money in order to implement the Food Safety Management Systems. The minimum total spend by any business in the group was €4,200. The maximum spent by single premises was €48,400, with the average total spend being €21,646. All the study participants were small businesses. The largest had only 21 employees. Additional expenditure of a few thousand euros would be considered significant for a small family run business, but many were required to spend considerably more to comply with the

expected standards. Some Food Business Operators reported that the expenditure used all of the annual profits while others were obliged to borrow money to cover the implementation. By the end of the final phase, one business had closed due to financial difficulty. A similar initiative in Scotland where small and medium sized butchers were required to implement HACCP as part of a licencing initiative showed that 25% of the participants did not have to make any additional expenditure to implement the specially designed HACCP system, while 36% were able to successfully implement the system by spending less than £1000(€1240). (Wheelock, 2002). A similar study in England estimated the average cost for implementation to the Food Business Operator was £858.78 (€1070) (Mortlock, *et al.*, 1999). In the UK the training and consultancy was subsidized by the national government (Smith, *et al.*, 2002) but even accounting for this subsidy, the costs incurred by the businesses in Cyprus do seem to be excessively high by comparison. The attitude of the Food Business Operators became increasingly more negative to Food Safety Management Systems as the study progressed. This may have been due to the difficulty in implementing a system which was too complex for the business but the substantial expenditure required in some of the premises may also have been a contributory factor.

The results of the audit, attitude questionnaire and follow up visit in 2014 suggest that the Food Business Operators were initially enthusiastic about improving the food safety management in their premises, willing to implement new systems, train staff and renovate their premises. This is demonstrated by the higher audit scores and more positive attitude scores at levels 2 and 3 in comparison with the scores at level 1. However as the systems became more complex, the difficulty and cost associated with the process presented barriers which were too high. The Food Business Operators did not continue implementing the systems once a certain level of complexity was reached. Structural improvements were permanent but the application of procedures, especially record keeping were not maintained.

The barriers to implementing HACCP for small businesses have been well documented (Holt & Henson, 2000) (Taylor & Kane, 2005) (Yapp & Fairman, 2006) (Violaris, *et al.*, 2008). A simplified system which complies with the requirements of article 5 of Regulation (EC)852/2004 but does not overburden the Food Business Operator can be instrumental in overcoming these barriers (Taylor, 2008) (Dzwolak, 2014). The Food Standards Agency in the United Kingdom recommends the use of such a simplified system, known as Safer Food Better Business which has been developed specifically for the food service sector. (Food Standards Agency, nd). This bespoke system has been well received by the UK Food Business Operators in small food service businesses and implementation has been shown to make a significant improvement in premises hygiene (Acosta, 2008).

5. Conclusion

An assessment of Food Safety Management System implementation in a sample of 50 small food businesses in Cyprus demonstrated an improvement in premises hygiene, with the most significant improvements occurring after the implementation of PRP's and a bespoke HACCP plan. Increasing the system complexity by imposing the CYS 244 or ISO 2200 standards resulted in a deterioration of hygiene as measured by the audit and some sampling results. However, the final standard was generally higher than at the start of the study, suggesting the premises generally had better hygiene after the study period. This may have been due to the improved hygiene knowledge demonstrated by the food handling staff. The attitude of the Food Business Operators was generally in favour of Food Safety Management Systems at the start of the study but became less positive after the imposition of the CYS 244 and ISO 2200 standards. Because of the difficulties faced by Food Business Operators in trying to implement these more complex systems, 90% wished to stop using them, and by 2014 75% of them were no longer using even a formal HACCP system. A further 10% had closed. All the Food Business Operators reported substantial costs related to the implementation of the systems.

Acknowledgments

The authors are very grateful to the Food Business Operators and staff of the participating food businesses for their cooperation, commitment and good will.

References

- Acosta, N., 2008. *Evaluation of the Effectiveness of Pre- Requisite Programmes and HACCP in Small sized Catering Businesses in Birmingham*, University of Birmingham: Unpublished PhD thesis.
- Anonymous, 2000. *Greek Standard ELOT - Risk Assessment Hazard Analysis Critical Control Points(HACCP)*, Athens: Greek Standardization Organization .
- Anonymous, 2001a. *CYS 244 Food Management Standard*, Cyprus: s.n.
- Anonymous, 2001b. *General State Laboratory Microbiological Criteria for Food*, Nicosia: Ministry of Health.
- Anonymous, 2005. *Business Economic Report*, Cyprus: Statistical Service of Cyprus.
- Charalambous, M., 2011. *Implementation of Food Safety Management Systems in Small Enterprises in Cyprus*, University of Birmingham: unpublished PhD Thesis.
- Cochran, W., 1977. *Sampling Techniques*. third ed. New York: John Wiley & Soncs.
- Dzwolak, W., 2014. HACCP in Small Food Businesses -the Polish Experience. *Food Control*, Volume 36, pp. 132-137.
- EFET, 2004. *Inspection Guide for Food Establishments*, Athens: EFET.
- Food Standards Agency, nd. *Safer Food Better Business*. [Online]
Available at: <http://www.food.gov.uk/business-industry/caterers/sfbb>
[Accessed 3 November 2014].
- Holt, G. & Henson, S., 2000. Quality Assurance in Small Meat Manufacturers. *Food Control*, Volume 11, pp. 319-326.
- Kirby, M. & Gardiner, K., 1997. The Effectiveness of Hygiene Training for Food Handlers. *International Journal of Environmental Health Research* , Volume 7, pp. 251-258.
- Mensah, L. & Julien, D., 2011. Implementation of Food Safety Management Systems in the UK. *Food Control*, Volume 22, pp. 1216-1225.
- Mortlock, M., Peters, A. & Griffith, C., 1999. *Report Evaluating the Costs, Attitude and Training involved with accelerated HACCP implementaion in English Butchers shops*, Cardiff: Meat and Livestock Commission.
- Smith, M., Hunedy, O. & Anvarian, A., 2004. *Safer Food Better Business, Developing the Principles of HACCP Management System to Apply in Balti Restaurants: Final Report Project H01005*, London: Food Standards Agency.
- Smith, M., Hussein, S. & Milward, J., 2002. Effect of the Licensing Process on Hygiene in Retail Butchers 'Premises in the West Midlands, United Kingdom. *Journal of Food Protection*, 65(9), pp. 1428-32.

- 475 Taylor, E., 2008. A New Method of HACCP for Catering and the Food Service Industry. *Food*
476 *Control*, Volume 19, pp. 126-134.
- 477 Taylor, E. & Kane, K., 2005. Reducing the Burden of HACCP on SME's. *Food Control*, Volume 16,
478 pp. 833-839.
- 479 Violaris, Y., Bridges, O. & Bridges, J., 2008. Small Businesses -Big Risks: Current Status and Future
480 Direction if HACCP in Cyprus. *Food Control* , Volume 19, pp. 439-448.
- 481 Wheelock, V., 2002. *Evaluation of Butchers' Shop Licensing Initiative in Scotland: Final Report*
482 *Project Code S01011*, London: Food Standards Agency, Scotland.
- 483 Yapp, C. & Fairman, R., 2006. Factors Affecting Food Safety Compliance within Small and
484 Medium-sized Enterprises: Implications for Regulatory and Enforcement Strategies. *Food*
485 *Control*, Volume 17, pp. 42-51.

Table 1 water samples

Parameter	Applied Technique/Standard
Total number bacteria	CYS EN 6222:1999
Coliforms	APHA 9222 B:1992
Faecal coliforms	APHA 9221 E:1992
Enterococcus spp.	EΛOT:947.2:1996
pH	EΛOT:658:1983
CaCO ³	APHA 2320 B:1998
Cl	APHA 4500-Cl(B):1992
SO ⁴	APHA 4500- SO ⁴ (E):1992
NO ³	APHA 4500- NO ³ (E):1998
NO ² -N	APHA 4500- NO ² (B):1998
Na	APHA 3500- Na (D):1992
K	APHA 3500- K (D):1992
Ca	APHA 3500- Ca (D):1992
Mg	APHA 3500- Ca(D):1992

Table 2 summary of median, minimum and maximum scores for parts A-E of the audit checklist.

Audit	Part A Structure & Facilities Median Score (min/max) n=50	Part B Cleaning & Disinfection Median Score (min/max) n=50	Part C Process Control Median Score (min/max) n=50	Part D Sampling Median Score (min/max) n=50	Part E FSMS Implementation Median Score (min/max) n=50
1	10.9 (6/20)	12 (8/19)	11 (5/18)	2 (1/4)	0 (0/0)
2	25.5 (13/33)	18 (12/20)	13 (7/18)	2 (1/4)	0 (0/0)
3	27 (15/33)	19 (16/20)	14 (9/18)	5 (4/5)	85 (60/98)
4	27.73 (20/33)	18.5 (15/20)	15 (11/18)	5 (4/5)	89 (73/98)
5	27.73 (20/33)	17 (11/19)	12.95 (9/18)	5 (4/5)	63 (32/89)
Maximum Possible	33	20	18	5	99

Table 3 Mean and Standard deviation for the environmental (surface) swabs

Test (n=50)	Mean (\log_{10} CFU/cm ²)
1	3.21 \pm 0.42
2	2.78 \pm 0.56
3	2.68 \pm 0.46
4	2.87 \pm 0.46
5	2.96 \pm 0.44

Highlights

Food safety management implementation was evaluated in 50 small food businesses

Maximum improvement in hygiene coincided with simple management systems

Complex systems such as ISO 22000 resulted in a deterioration of hygiene